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(54) [TITLE OF THE INVENTION]

POLARIZER, POLARIZING PLATE, LIQUID CRYSTAL DISPLAY DEVICE AND ITS PRODUCTION

(57)Abstract:

PROBLEM TO BE SOLVED: To reduce the thickness of a device, to diminish members and to prevent the peeling of an adhesive layer from the glass surface of a liq. crystal cell by using a polarizer with adhesive layers on both sides of an oriented dichroic molecule layer.

SOLUTION: Adhesive layers are formed on both sides of an oriented dichroic molecule layer consisting of dichroic molecules and additives such as a surfactant added if necessary. Unlike the conventional polarizing element or polarizing plate,

the dichroic molecule layer does not contain an orientation controlling material such as PVA. The dichroic molecules are molecules of a compd. exhibiting polarizing property by arrangement in a certain direction and a compd. having an arom. cyclic structure is preferably used. A reflection type liq. crystal display device consists of a reflecting plate 1, an adhesive layer 2, a polarizer 3 with a layer of only dichroic molecules, a liq. crystal cell 4 and a polarizing plate 5. The reflection type liq. crystal display device unnecessitates a light source because external light is used as a light source but a light source is required in the case of a transmission type liq. crystal display device.

[Claims]

[Claim 1] A polarizer comprising adhesive layers on both sides of an oriented dichromatic molecule layer.

[Claim 2] A polarizing plate comprising an optically transparent or optically reflective base material on one surface, and a peelable base material on the other surface of said polarizer according to Claim 1.

[Claim 3] A polarizing plate according to Claim 2, wherein a total light transmittance of said optically transparent base material is not smaller than 20%.

[Claim 4] A method of manufacturing a polarizing plate, characterized in that a dichromatic molecule layer is provided on a substrate having a characteristic to orient dichromatic molecules to orient the dichromatic molecules, an adhesive layer surface of a peelable base material having an adhesive layer is then stacked on said dichromatic molecule layer, said dichromatic molecule layer is then transcribed to said adhesive layer by peeling off said base material, and an adhesive layer surface of an optically transparent or optically reflective base material having an adhesive layer is subsequently stacked on a transcribed dichromatic molecule layer surface.

[Claim 5] A transparent or a reflective liquid crystal display comprising said polarizer according to Claim 1 between an optically transparent or optically reflective base material surface and a glass surface of a liquid crystal cell.

[Claim 6] A method of manufacturing a transparent or a high reflective liquid crystal display characterized in that an adhesive layer is exposed by peeling off said polarizing plate on said peeling base material according to Claim 2 or 3, and said adhesive layer of said polarizing plate is then stacked on a glass surface of a liquid crystal cell.

[DETAILED DESCRIPTION OF THE INVENTION]

[0001]

[Field of the Invention]

The present invention relates to a polarizer, a polarizing plate, and a liquid crystal display provided with this polarizer which are extremely small in thickness, and its manufacturing method.

[0002]

[Description of the Prior Art]

A polarizing plate used for a liquid crystal display can formerly be obtained to dispose a polarizing element between protective films such as triacetyl celluloses, and the polarizing element is obtained in such a manner that dichromatic molecules such as iodine or dyes are dissolved or absorbed into an orientation controller consisting of high polymer materials such as polyvinyl alcohol, and the film is then stretched in one direction to orient the dichromatic molecules, or in such a manner that above dichromatic molecules are made to be

absorbed into a film stretched in one axis direction.

[0003]

However, according to the manners described above, since the orientation controller for orienting the dichromatic molecules must be stretched, there have been restrictions to produce only a polarizing plate which is oriented only in one direction.

[0004]

In contrast to this, as disclosed in JP-A-7-261024 (the term "JP-A" as used herein means an "unexamined published Japanese patent application"), such a polarizing plate is reported recently that does not require a stretching process at all and additionally has an arbitrary polarizing axis, by means of providing a molecular layer showing dichroism on an orientation controller such as a layer having optically activated molecules formed on a substrate, a substrate to which a rubbing process has been performed, a substrate having a birefringence property or the like.

[0005]

[PROBLEMS THAT THE INVENTION IS TO SOLVE]

A liquid crystal display has been improved to be small in thickness and in weight, and all members in connection with the display have been improved to be small in size, in thickness, and in weight in recent years. However, in such situations, only a portion of the polarizing plate has not been made

sufficiently small in size, since both polarizing plates employing a conventional manufacturing method and a method according to JP-A-7-261024 have always had an orientation controller for orienting dichromatic molecules in a specific direction. Particularly, in the conventional method of a polarizing plate using a polyvinyl alcohol film or the like as an orientation controller, since the stretched polyvinyl alcohol film tends to tear in an stretching direction, protective layers must be additionally provided in both sides thereof, so that there has existed a problem of increasing a thickness of the whole liquid crystal display. Moreover, in the conventional method of forming a polarizing plate by stretching polyvinyl alcohol, there has also existed a problem that an adhesive between a glass surface and a polarizing plate of a liquid crystal cell must be peeled off since the stretched polyvinyl alcohol film has shrunk with heat or humidity. For that reason, to solve these problems have been continuously expected.

[0006]

[MEANS OF SOLVING THE PROBLEMS]

As a result of intensive studies in view of such a situation, the present inventors have achieved the present invention. That is, the present invention is related to

(1) a polarizer having adhesive layers on both sides of an oriented dichromatic molecule layer,

(2) a polarizing plate which has an optically transparent or optically reflective base material on one external surface of the polarizer according to (1), and has a peelable base material on the other external surface thereof,

(3) a polarizing plate according to (2), wherein a total light transmittance of the optically transparent base material is 20% or more,

(4) a method of manufacturing a polarizing plate, characterized in that a dichromatic molecule layer is first provided on a substrate having a characteristic of orienting dichromatic molecules to orient the dichromatic molecules, an adhesive layer surface of a peelable base material having an adhesive layer is then stacked on this dichromatic molecule layer, this dichromatic molecule layer is then transcribed to this adhesive layer by peeling off the base material, and an adhesive layer surface of an optically transparent or optically reflective base material having an adhesive layer is finally stacked on the transcribed dichromatic molecule layer surface,

(5) a transparent or a high reflective liquid crystal display characterized in that the polarizer according to (1) is disposed between the optically transparent or optically reflective base material surface and a glass surface of a liquid crystal cell, and

(6) a method of manufacturing a transparent or a high reflective liquid crystal display characterized in that the

peelable base material on the polarizing plate according to (2) or (3) is peeled off to expose the adhesive layer, and this adhesive layer of this polarizing plate is then stacked on a glass surface of a liquid crystal cell.

[0007]

[DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS]

A dichromatic molecule layer according to the present invention is a layer in which dichromatic molecules are oriented, and a polarizer of the present invention shows its deflection performance because of the presence of this layer. This dichromatic molecule layer consists of the dichromatic molecules and additive agents, such as surface active agents or the like, added as needed, and it is a layer in which an orientation control material such as polyvinyl alcohol or the like does not exist in contrast to a conventional polarizing element or a polarizing plate.

[0008]

In the present invention, the dichromatic molecule used for the dichromatic molecule layer is a compound showing a polarizing characteristic by means of orienting in a fixed direction of its own or as aggregate; and the compound having, for example an aromatic ring structure is preferable. As the aromatic ring structure, heterocycle such as thiazole, pyridine, pyrimidine, pyridazine, pyrazine, and quinoline other than benzene, naphthalene, anthracene, and phenanthrene, or

quarternary of these are preferable, and a condensed ring of these with benzene, naphthalene, or the like is further preferable. Moreover, it is preferred that hydrophilic substituent groups, such as sulfonic acid groups, amino groups, and hydroxyl groups, are introduced into these aromatic rings.

[0009]

As specific example, the dichromatic molecules include dye compounds such as azo-based dyes, stilbene-based dyes, pyrazolone-based dyes, triphenylmethane-based dyes, quinoline-based dyes, oxazine-based dyes, thiazine-based dyes, and anthraquinone-based dyes, or the like. The dyes are preferably water-soluble, but are not limited thereto. Further, it is preferred that hydrophilic substituent groups, such as sulfonic acid groups, amino group, and hydroxyl groups, are introduced into these dichromatic molecules. Specific examples of the dichromatic molecules include C.I. Direct Yellow 12, C.I. Direct Orange 39, C.I. Direct Orange 72, C.I. Direct Red 39, C.I. Direct Red 79, C.I. Direct Red 81, C.I. Direct Red 83, C.I. Direct Red 89, C.I. Direct Violet 48, C.I. Direct Blue 67, C.I. Direct Blue 90, C.I. Direct Green 59, and C.I. Acid Red 37, and further include dyes described in each of JP-A-1-161202, JP-A-1-172906, JP-A-1-172907, JP-A-1-183602, JP-A-1-248105, JP-A-1-265205, and JP-A-7-261024. These dichromatic molecules are used as free acids, alkali metal salts, ammonium salts, or amine salts. A polarizer having various hues

can be produced by means of mixing two or more kinds of these dichromatic molecules. A polarizing element or a polarizing plate containing a compound (dye) exhibiting black when a polarizing axis intersects at right angles, or containing various kinds of dichromatic molecules so as to show black is preferably excellent in both single plate transmittance and polarizing degree.

[0010]

Although the adhesive layer according to the present invention is preferably transparent, one layer among two adhesive layers existing in the polarizer according to the present invention may be an opaque adhesive produced by diffusing a pearl pigment or the like in the adhesive. This opaque adhesive layer is used for a layer to adhere the optically transparent or optically reflective base material of the polarizing plate according to the present invention. Further, the thickness of the adhesive layer according to the present invention is preferably small in thickness, when making a liquid crystal display to be obtained small in thickness, and it is preferably, for example, not larger than 100 .mu.m, and is particularly preferably about 10 to 50 .mu.m.

[0011]

In the present invention, although there are no particular limitations on adhesives used for the adhesive layer as far as it can combine a material with each other, it is

preferably a pressure-sensitive adhesive. Specific examples include, for example acrylate resin based adhesives. The acrylate resin based adhesives include, for example copolymers of (meta) acrylic acid alkyl esters and other polymerizing monomers. The (meta) acrylic acid alkyl esters include, for example (meta) methyl acrylate, (meta) ethyl acrylate, (meta) acrylic acid isopropyl, (meta) acrylic acid n-butyl, (meta) acrylic acid t-butyl, (meta) acrylic acid dodecyl, or the like. One or more kinds of these (meta) acrylic acid alkyl esters may be used. Other polymerizing monomers include, for example polymerizing monomers having carboxyl groups in molecules, polymerizing monomers having hydroxyl groups in molecules, polymerizing monomers having amide groups in molecules, and monomers not containing functional groups, or the like. Two or more kinds of these other polymerizing monomers are generally used. The acrylate resin based adhesives used for the present invention can be produced with ease by dissolving a monomer to be used into an organic solvent and performing radical copolymerization employing a commonly known method.

[0012]

The optically transparent or optically reflective base material layer is provided on one external surface of the polarizer according to the present invention, and the peelable base material layer is provided on the other external surface thereof, thereby obtaining the polarizing plate capable of

adhering to a desired place. A thickness of the optically transparent or optically reflective base material layer is preferably small in thickness, when making a liquid crystal display to be obtained small in thickness, thus it is preferably, for example not larger than 500 .mu.m, is more preferably about 10 to 200 micrometer, and is further preferably about 50 to 100 .mu.m.

[0013]

The optically transparent or optically reflective base material includes, for example transparent plastic films, films into which these films have been treated, milk white films, or the like. The plastic film includes films made from, for example polyolefin resins such as polyethylene, polypropylene, or the like, polyester resins such as polyethylene terephthalate, or the like, polystyrene, polyurethane, vinyl chloride, acryl resins, polycarbonate resins, acrylate resins, and the films into which these films have been treated include films in which fine air bubbles are formed. Further, the milk white films include, for example films which are made by means of adding metal oxides, such as titanium oxide, to these plastics. Further, the above films have a total light transmittance of preferably 20% or more in a visible light region, and of preferably 30 to 60% when used for a liquid crystal display capable of both transparent and high reflective functions.

[0014]

The optically reflective base material can be obtained in such manners that an ultraviolet ray cured resin into which particles have been diffused is coated on, for example above plastic film, a surface having fine unevenness is then formed thereon by means of irradiating an ultraviolet ray, and further, reflective materials such as metal materials, for example aluminum, silver, or the like are evaporated thereon; and in a manner that a rolled metallic foil is stacked on the plastic film; or the like.

[0015]

The peelable base material includes such a film that peeling process is performed to a surface of, for example a plastic film with silicone based resins, fluororesins, or the like.

[0016]

The polarizer and the polarizing plate according to the present invention are produced as follows, for example. That is, a dichromatic molecule layer is first provided on a substrate (orientation controller) having a characteristic of orienting dichromatic molecules to orient the dichromatic molecules, an adhesive layer surface of a peelable base material having an adhesive layer is then stacked on this dichromatic molecule layer, this dichromatic molecule layer is then transcribed to this adhesive layer by means of peeling off the

base material, and an adhesive layer surface of an optically transparent or optically reflective base material having an adhesive layer is finally stacked on the transcribed dichromatic molecule layer surface. In addition to that, the peeled substrate which still has the characteristic to orient the dichromatic molecules can be used again for producing the polarizer and the polarizing plate.

[0017]

The substrate having the characteristic to orient the dichromatic molecules (orientation controller) includes, for example a substrate having an optically activated molecule layer where a molecule axis orientation change has been effected by means of irradiating a linearly polarized light, a substrate to which rubbing process has been performed, a substrate having a birefringence property, or the like. The substrate having the birefringence property includes substrates (films), for example polycarbonate resins, polyester resins, polystyrene based resins, or the like, and it is preferable that the stretching process has been performed to these resin substrates.

[0018]

The substrate provided with the optically activated molecule layer and the substrate to which the rubbing process is performed, may be a substrate to which the optically activated molecules can be combined or applied, or to which the

rubbing process can be performed, and for example, glass plates and quartz plates such as silica based glasses and hard glasses, plastic plates and sheets (films) of various materials, such as ABS plastics; acetal resins; (meta) acrylate resins; triacetyl cellulose; chlorinated polyether; ethylene-vinyl acetate copolymer, fluoroplastics; polyester such as ionomer, methyl pentene polymer, nylon, polyamide, polycarbonate, polyethylene terephthalate, and polybutylene terephthalate; polyimide; polyphenylene oxide; polyphenylene sulfide; polyallyl compound sulfone; polyarylate; polyethylene; polypropylene; polystyrene; polysulfone; vinyl acetate resins; vinylidene chloride resins; AS resins; vinyl chloride resins; alkyd resins; allylic resins; amino resins; urea resins; melamine resins; epoxy resins; phenol resins; unsaturated polyester resins; silicone resins; polyurethane, or the like; or plates, the surfaces of which is covered with metal oxides such as oxidation silicon, tin oxide, oxidation indium, aluminum oxide, titanium oxide, chrome oxide, zinc oxide, or the like; silicon nitride; silicon carbide; or the like. Alternatively, substrates (films), the surfaces of which are covered with metal thin films having high reflective degree, can also be used.

[0019]

In order to provide the dichromatic molecule layer on the substrate having the characteristic to orient the dichromatic

molecules, following steps will be performed, for example. A single dichromatic molecule or a mixture of a plurality of dichromatic molecules are dissolved into a hydrophilic solvent such as water, methanol, ethanol, or the like, or its hydrous solvent, thereby obtaining a solution of the dichromatic molecule. A concentration thereof is preferably about 0.1 to 15 w/w%, and more preferably about 2.0 to 12 w/w%. A surface active agent may also be applied to this solution. Although any surface active agents of cation type, nonion type, and anion type may be used, the nonionic surface active agent is preferable. Next, the solution of this dichromatic molecule is dropped on a substrate having a characteristic to orient dichromatic molecules by a photogravure coater or the like, or on the surface of this substrate, is subsequently coated uniformly by a rotation coating manner, and is dried, so that a dichromatic molecule layer with a uniform thickness consisting of the above dyes is provided. Alternatively, after immersing this substrate into the solution of this dichromatic molecule, this substrate may be pulled up. In order to obtain a uniform concentration of dichromatic molecules, the pull-up speed is preferably kept constant. The thickness of the dichromatic molecule layer is preferably small in thickness from a viewpoint of improving in the polarization property, and it is preferably, for example not larger than 10 .mu.m, and particularly preferably 0.1 to 2 .mu.m.

[0020]

The substrate to which the above solution of dichromatic molecules has been adhered is dried, so that the dichromatic molecule layer in solid state is formed. Although drying conditions are varied depending on the type of solvent, the type of dichromatic molecule, solution volume of coated dichromatic molecules, concentration of dichromatic molecules, or the like, the temperature is from room temperature to 100.degree. C., preferably from room temperature to 60.degree. C., and the humidity is about 20 to 80%RH, preferably about 30 to 70%RH.

[0021]

Thus, only by making the dichromatic molecules absorb into the substrate having the characteristic for orienting the dichromatic molecules, a molecule axis of the dichromatic molecule orients in a specific direction on the substrate, so that a property as the polarizing element is exhibited. Since this anisotropically absorbing dichromatic molecule layer stays in a solid state of, for example an amorphous state, a crystalline state, or the like, and is easy to be peeled off, this dichromatic molecule layer is transcribed to the adhesive layer with the orientation retained by means of peeling the substrate after stacking the adhesive layer to this dichromatic molecule layer.

[0022]

The substrate, which is used in order to produce the

polarizer and the polarizing plate of the present invention, and has the optically activated molecule layer having effected the molecule axis orientation change, is obtained by means of, for example irradiating a linearly polarized light to the optically activated molecule layer provided on the substrate. A wavelength of the polarized light for irradiation is not particularly limited to, as far as the wavelength may be absorbed by the optically activated molecules, and for example, not only a visible light but a light having wavelength regions of an ultraviolet ray and/or an infrared ray may also be used. Any light sources, such as mercury-vapor lamps, xenon lights, fluorescent lamps, chemical lamps, helium cadmium lasers, argon lasers, krypton lasers, helium neon lasers, semiconductor lasers, and also sunlight, may be used, and it may be selected depending on absorption wavelength region of the optically activated molecules, light irradiation time, irradiated area or the like. In order to obtain the linearly polarized light, a linearly polarized light element and a linearly polarized light plate may be just combined with a light emitted from these light sources. For this purpose, the polarizing element and the polarizing plate include, for example prism type elements such as a Glan-Thompson prism, and a polarizing element and a polarizing plate consisting of a polymer membrane which is stretched after dissolving or absorbing the dichromatic molecules therein. The polarizing element (plate) produced

according to the present invention may also be used. Exposure energy of the linearly polarized light employed here is preferably in a range of from 1 mJ/cm^2 to 10 J/cm^2, although it changes depending on wavelength, structure of the optically activated molecules, combined state, irradiation temperature or the like. Incidentally, when a laser is used as the light source, if the laser beam itself is a linearly polarized light, the polarizing element (plate) is not required.

[0023]

In order to effect molecule axis orientation change in the optically activated molecule layer, the linearly polarized light may be just irradiated through a desired mask pattern to the optically activated molecule layer. By diverging or condensing the linearly polarized light using a lens or the like, the pattern can be expanded large, or the pattern can be conversely shrunk very fine. Further, when the laser is used as the light source and the laser beam itself is the linearly polarized light, very fine patterns can be drawn freely by combining with a polarization plane rotation element like a Faraday element. Moreover, since the molecule axis orientation change of the optically activated molecules by means of the linearly polarized light is reversible, the patterns can be overwritten freely by means of irradiating the linearly polarized light of different polarizing axes for every mask pattern.

[0024]

Incidentally, the optically activated molecule existing in the above optically activated molecule layer is a molecule, the molecule axis orientation change of which is effected by means of the linearly polarized light. The molecule axis orientation change mentioned here is a phenomenon where a direction of the molecule axis is changed once absorbing light energy of the linearly polarized light. Light activated molecules for this purpose include at least one double bond selected from C=C, C=N, and N=N, molecules, the double bond of which is non-aromatic, are effectively used. The wavelength of the light which this optically activated molecule absorbs is not limited to the wavelength region of the visible light, but also includes the wavelength regions of an ultraviolet ray and/or an infrared ray which are not observed with naked eyes. If the linearly polarized light including a wavelength range which this molecule absorbs is irradiated to this optically activated molecule layer, the molecule axis orientation change will be effected with ease. A specific example of such optically activated molecule and a method of providing this optically activated molecule on the substrate are described in, for example PCT Publication WO95/07474.

[0025]

The substrate, which is used in order to produce the polarizer and the polarizing plate according to the present

invention, and to which the rubbing process is performed, is obtained by means of rubbing an unprocessed substrate with rubbing agents in a fixed direction. As the rubbing agents, cloth, paper, leather, cotton, felt, buff or the like can be used, and can also be used with abrasive compounds, such as clay, zirconia, alumina or the like in some cases. Further, although a degree of rubbing depends on the rubbing agents, the number of rubbings is preferably in arrange of from 1 to 30 times.

[0026]

When providing the above dichromatic molecule layer, it is possible to further increase an orientation characteristic of the dichromatic molecules by performing corona discharge treatment or ultraviolet irradiation to the optically activated molecule layer and the surface, to which the rubbing process is to be applied before the linearly polarized light irradiation. Various commercial corona discharge treatment machines are applicable as an apparatus for performing the corona discharge treatment. Although conditions of corona discharge treatment change depending on the type of the substrate, composition and film thickness of the dichromatic molecule layer coated after the corona discharge treatment, and in addition when the optically activated molecule layer is treated, conditions such as the composition, the thickness or the like, an energy density per one treatment is about 20 to 400 $W \cdot min/m^2$, preferably about 50 to 300 $W \cdot min/m^2$. Whereas when one time treatment is

insufficient, a plurality of treatments could be performed. Additionally, when performing the ultraviolet irradiation, the wavelength of an ultraviolet ray to be used is preferably the wavelength of a far-ultraviolet ray of, for example 300 nm or less, but it is not particularly limited. Further, the ultraviolet irradiation is preferably performed under an oxygen air current. Various commercial ultraviolet ray irradiators can be applicable as an apparatus for performing the ultraviolet irradiation. Although conditions of ultraviolet irradiation change depending on the type of the substrate, composition and film thickness of the dichromatic molecule layer coated after the ultraviolet irradiation, and in addition when the optically activated molecule layer is treated, conditions such as composition, thickness or the like, the irradiation time is sufficient about several minutes at the longest.

[0027]

The liquid crystal display according to the present invention has the above polarizer between the optically transparent or optically reflective base material surface and the glass surface of the liquid crystal cell. A partial cross sectional plan view of one embodiment of this liquid crystal display is shown in Fig. 1. Fig. 1 is a partial cross sectional plan view showing a high reflective liquid crystal display. In Fig. 1, reference numeral 1 represents a reflecting plate, reference numeral 2 represents an adhesive layer, reference

numeral 3 represents a polarizer consisting only of dichromatic molecules, reference numeral 4 represents a liquid crystal cell section, and reference numeral 5 represents a polarizing plate. Although a light source section is unnecessary in order that the high reflective liquid crystal display may use an outside light as a light source, the transparent liquid crystal display needs the light source section.

[0028]

In the liquid crystal cell section 4 of the liquid crystal display according to the present invention, for example, a liquid crystal is filled between two glass substrates arranged in a fixed space by a spacer, and internal electrodes are provided inside an upper glass substrate and in an interior of a lower glass substrate, respectively. The internal electrode is comprised of many fine pixel electrodes arranged vertically and horizontally.

[0029]

Although the polarizing plate 5 used for the liquid crystal display according to the present invention can employ various conventional polarizing plates, and includes, for example polarizing plates or the like which can be obtained in such a manner that dichromatic molecules such as iodine or dyes, are dissolved into or absorbed into an orientation control film consisting of high polymer materials such as polyvinyl alcohol, the film is then stretched in one direction to orient the

dichromatic molecules, and is then disposed between protective films such as triacetyl cellulose using suitable adhesives. As a matter of course, the polarizer and the polarizing plate according to the present invention may be employed.

[0030]

A liquid crystal display according to the present invention can be obtained in such a manner that a film, to which peeling process has been performed, on the above polarizing plate according to present invention is peeled off to expose an adhesive layer, then this adhesive layer on the polarizing plate is stacked to the glass surface of the liquid crystal cell.

[0031]

[Example]

Hereafter, referring to embodiments and comparative examples, the present invention is still more specifically described.

Example

Corona discharge treatment is first performed to an optically activated molecule surface of a film-shaped substrate having the optically activated molecules of this embodiment, and an extra high pressure mercury lamp of 500 W/h is then irradiated through a polarizing plate. This optically activated molecule surface is then coated with an aqueous solution which is obtained by dissolving a black mixed 10% by weight of dyestuff (Blackl) consisting of C.I. Direct Orange 72, C.I. Direct Blue

67, C.I. Direct Green 51 and 0.1% by weight of a nonionic-based surface active agent Emergen 108 (Made by Kao) into 89.9% by weight of water, and is then dried, so that a substrate having the oriented dichromatic molecule layer is obtained. Next, a sheet having acrylic pressure sensitive adhesive with a thickness of 20 .mu.m on a film, to which the peeling process has been performed, is adhered to a dichromatic molecule layer surface of the obtained substrate, and then the substrate having the optically activated molecule is peeled off. Next, a reflective sheet with a thickness of 100 .mu.m provided with an acrylic pressure sensitive adhesive layer with a thickness of 20 .mu.m is adhered to the dichromatic molecule layer transcribed to the adhesion layer, so that a polarizing plate having the polarizer according to the present invention is obtained. A polarizing degree of this polarizing plate exhibits 90.0%. The film, to which the peeling process has been performed, on the polarizing plate is peeled off, and it is adhered to a glass surface of a liquid crystal cell having the polarizing plate on one side with a thickness of 2190 .mu.m, so that a high reflective liquid crystal display according to the present invention is finally obtained. A thickness of this liquid crystal display ends up 2330 .mu.m.

[0032] Comparative Example

The high reflective liquid crystal display is obtained in a similar manner to that of the embodiment, except for

employing the polarizing plate with a thickness of 180 .mu.m disposed between the conventional triacetyl cellulose instead of the polarizing plate having the polarizer of the comparative example according to the present invention. A thickness of this liquid crystal display ends up 2.510 mm.

[0033]

As can be seen from the embodiment and the comparative example, it will be understood that a thickness of the whole display device of the liquid crystal display according to the present invention is significantly reduced in thickness as compared with that of the comparative example.

[0034]

EFFECT OF THE INVENTION

In the liquid crystal display according to the present invention, the polarizer having adhesive layers on both sides of the oriented dichromatic molecule layer is disposed between the transparent or reflective film and the glass surface of the liquid crystal cell, accordingly it is possible to make the device small in thickness, reduce the members, and prevent the adhesive layer from being peeled off from the glass surface of the liquid crystal cell by employing this liquid crystal display. Further, the polarizer and the polarizing plate according to the present invention are useful for making such a liquid crystal display small in thickness and for an approach to reduce the members.

[BRIEF DESCRIPTION OF THE DRAWINGS]

Fig. 1 is a partial cross sectional plan view showing one embodiment of a liquid crystal display according to the present invention.

[SYMBOL]

1: Reflective base

2: adhesive layer

3: Polarizer

4: Liquid crystal cell

5: Polarizer